

6-16 SOLDIER PILE AND SOLDIER PILE TIEBACK WALLS**6-16.1 Description**

This Work consists of constructing soldier pile walls and soldier pile tieback walls.

6-16.2 Materials

Materials shall meet the requirements of the following sections:

Controlled Density Fill	2-09.3(1)E
Cement	9-01
Aggregates for Portland Cement Concrete	9-03.1
Gravel Backfill	9-03.12
Premolded Joint Filler	9-04.1(2)
Welded Shear Studs	9-06.15
Steel Reinforcing Bar	9-07.2
Epoxy-Coated Steel Reinforcing Bar	9-07.3
Paints	9-08
Timber Lagging	9-09.2
Preservative Treatment for Timber Lagging	9-09.3(1)
Soldier Piles	9-10.5
Concrete Curing Materials and Admixtures	9-23
Fly Ash	9-23.9
Water	9-25
Prefabricated Drainage Mat	9-33.2(3)

Other materials required shall be as specified in the Special Provisions.

6-16.3 Construction Requirements**6-16.3(1) Quality Assurance**

The steel soldier piles shall be placed so that the centerline of the pile at the top is within 1-inch of the Plan location. The steel soldier pile shall be plumb, to within 0.5-percent of the length based on the total length of the pile.

Welding, repair welding, and welding inspection shall conform to the Section 6-03.3(25) requirements for welding, repair welding, and welding inspection for all other steel fabrication.

6-16.3(2) Submittals

The Contractor shall submit shop plans as specified in Section 6-03.3(7) for all structural steel, including the steel soldier piles and the permanent ground anchors to the Engineer for approval.

The Contractor shall submit the permanent ground anchor grout mix design and the procedures for placing the grout to the Engineer for approval.

The Contractor shall submit forming plans for the concrete fascia panels, as specified in Sections 6-02.3(16) and 6-02.3(17), to the Engineer for approval.

1. Where the lateral pressure from concrete placement, as specified in Section 6-02.3(17)J, is less than or equal to the design earth pressure, the Contractor may tie forms directly to the soldier piles.

2. Where the lateral pressure from concrete placement, as specified in Section 6-02.3(17)J, is greater than the design earth pressure, the Contractor shall follow 1 of the following procedures:
 - a. Tie the forms to strongbacks behind the lagging, or use some other system that confines the pressure from concrete placement between the lagging and the form panels, in addition to the ties to the soldier piles.
 - b. Reduce the rate of placing concrete to reduce the pressure from concrete placement to less than or equal to the design earth pressure in addition to the ties to the soldier piles.
 - c. Follow a procedure with a combination of a. and b.
3. The Contractor shall design the forms for an appropriate rate of placing concrete so that no cold joints occur, considering the wall thickness and height, and volume of concrete to be placed.

The Contractor shall submit 4 copies of a shaft installation plan in accordance with Section 6-01.9 not less than 30-calendar days prior to the beginning of shaft construction. In preparing the submittal, the Contractor shall reference the available subsurface data provided in the Contract test hole boring logs and the geotechnical report(s) prepared for this project. This plan shall provide at least the following information:

1. An overall construction operation sequence and the sequence of shaft construction.
2. List, description, and capacities of proposed equipment including but not limited to cranes, drills, augers, bailing buckets, final cleaning equipment, and drilling units. The narrative shall describe why the equipment was selected, and describe equipment suitability to the anticipated site and subsurface conditions. The narrative shall include a project history of the drilling equipment demonstrating the successful use of the equipment on shafts of equal or greater size in similar soil/rock conditions.
3. Details of shaft excavation methods including proposed drilling methods, methods for cleanout of the shafts, disposal plan for excavated material and drilling slurry (if applicable), and a review of method suitability to the anticipated site and subsurface conditions.
4. Details of the method(s) to be used to ensure shaft stability (i.e., prevention of caving, bottom heave, etc. using temporary casing, slurry, or other means) during excavation and concrete placement. This shall include a review of method suitability to the anticipated site and subsurface conditions. If temporary casings are proposed, casing dimensions and detailed procedures for casing installation and removal shall be provided. If slurry is proposed, detailed procedures for mixing, using, maintaining, and disposing of the slurry shall be provided. A detailed mix design, and a discussion of its suitability to the anticipated subsurface conditions shall also be provided for the proposed slurry.
5. Details of soldier pile placement including internal support bracing and centralization methods.
6. Details of concrete placement including proposed operational procedures for pumping and/or tremie methods.

7. Details of the device used to prevent unauthorized entry into a shaft excavation.
8. The method to be used to form the horizontal construction joint at the top elevation specified for concrete Class 4000P in the shaft.

Work shall not begin until the Engineer has approved the appropriate submittals in writing.

6-16.3(3) Shaft Excavation

Shafts shall be excavated to the required depth as shown in the Plans. The minimum diameter of the shaft shall be as shown in the Plans. The excavation shall be completed in a continuous operation using equipment capable of excavating through the type of material expected to be encountered.

The Contractor may use temporary telescoping casing to construct the shafts.

If the shaft excavation is stopped the shaft shall be secured by installation of a safety cover. It shall be the Contractor's responsibility to ensure the safety of the shaft and surrounding soil and the stability of the sidewalls. A temporary casing, slurry, or other methods specified in the shaft installation plan as approved by the Engineer shall be used if necessary to ensure such safety and stability.

Where caving in conditions are encountered, no further excavation will be allowed until the Contractor has implemented the method to prevent ground caving as submitted in accordance with item 4 of the Shaft Installation Plan and as approved by the Engineer.

No more than 2-inches of loose or disturbed material, for soldier piles with permanent ground anchors, nor more than 12-inches of loose or disturbed material, for soldier piles without permanent ground anchors, shall be present at the bottom of the shaft just prior to beginning concrete placement.

The excavated shaft shall be inspected and approved by the Engineer prior to proceeding with construction.

When obstructions are encountered, the Contractor shall notify the Engineer promptly. An obstruction is defined as a specific object (including, but not limited to, boulders, logs, and man made objects) encountered during the shaft excavation operation that prevents or hinders the advance of the shaft excavation. When efforts to advance past the obstruction to the design shaft tip elevation result in the rate of advance of the shaft drilling equipment being significantly reduced relative to the rate of advance for the rest of the shaft excavation, then the Contractor shall remove the obstruction under the provisions of Section 6-16.5 as supplemented in the Special Provisions. The method of removal of such obstructions, and the continuation of excavation shall be as proposed by the Contractor and approved by the Engineer.

Excavation of shafts shall not commence until a minimum of 12-hours after the shaft backfill for the adjacent shafts has been placed.

The temporary casings for the shafts shall be removed. A minimum 5-foot head of concrete shall be maintained to balance the soil and water pressure at the bottom of the casing. The casing shall be smooth.

6-16.3(4) Installing Soldier Piles

Soldier piles, if spliced, shall conform to all requirements of Section 6-05.3(6).

The prefabricated steel soldier piles shall be lowered into the drilled shafts and secured in position. Concrete cover over the soldier pile shall be 1-inch minimum.

The steel soldier piles and attachments shall be shop painted after fabrication to the limits shown in the Plans with 1 coat of inorganic zinc primer. Application of the 1 coat of primer shall be in accordance with Section 6-07. The welded shear studs may be attached before or after painting. Paint damaged by welding shear studs in place does not require repair.

6-16.3(5) Backfilling Shaft

The excavated shaft shall be backfilled with either controlled density fill (CDF), or pumpable lean concrete, as shown in the Plans and subject to the following requirements:

1. Dry shaft excavations shall be backfilled with CDF.
2. Wet shaft excavations shall be backfilled with pumpable lean concrete.
3. Pumpable lean concrete shall be a Contractor designed mix providing a minimum 28-day compressive strength of 100-psi. Acceptance of pumpable lean concrete will conform to the acceptance requirements specified in Section 2-09.3(1) for CDF.
4. A wet shaft is defined as a shaft where water is entering the excavation and remains present to a depth of 6-inches or more.
5. When the Plans or test hole boring logs identify the presence of a water table at or above the elevation of the bottom of soldier pile shaft, the excavation shall be considered as wet, except as otherwise noted. Such a shaft may be considered a dry shaft provided the Contractor furnishes and installs casing that is sufficiently sealed into competent soils such that water cannot enter the excavation.

Placement of the shaft backfill shall commence immediately after completing the shaft excavation and receiving the Engineer's approval of the excavation. CDF or pumpable lean concrete shall be placed in 1 continuous operation to the top of the shaft. Vibration of shaft backfill is not required.

If water is not present, the shaft backfill shall be deposited by a method that prevents segregation of aggregates. The shaft backfill shall be placed such that the free-fall is vertical down the shaft without hitting the sides of the soldier pile or the excavated shaft. The Contractor's method for depositing the shaft backfill shall have approval of the Engineer prior to the placement of the shaft backfill.

If water is present, the shaft backfill shall be deposited in accordance with Section 6-02.3(6)B.

6-16.3(6) Installing Timber Lagging and Permanent Ground Anchors

The excavation and removal of CDF and pumpable lean concrete for the lagging installation shall proceed in advance of the lagging, and shall not begin until the CDF and pumpable lean concrete are of sufficient strength that the material remains in place during excavation and lagging installation. If the CDF or pumpable lean concrete separates from the soldier pile, or caves or spalls from around the pile, the Contractor shall discontinue excavation and timber lagging installation operations until the CDF and pumpable lean concrete is completely set. The bottom of the excavation in front of the wall shall be level. Excavation shall conform to Section 2-03.

For walls without permanent ground anchors, the bottom of excavation shall be not more than 3-feet below the bottom level of the timber lagging already installed. For walls with permanent ground anchors, the bottom of excavation shall be not more than 3-feet below tieback anchor level until all permanent ground anchors at that level are installed

and stressed. Installing, stressing, and testing the permanent ground anchors shall be in accordance with Section 6-17 and the construction sequence specified in the Plans.

Unless otherwise specified, timber lagging in walls with concrete fascia panels shall be untreated. Timber lagging for all other walls shall be treated.

The lagging shall be installed from the top of the pile proceeding downward. The timber lagging shall make direct contact with the soil. Voids shall be filled with gravel backfill for walls, which shall be considered incidental to the installation of the timber lagging.

Where timber lagging and backfill are above the existing or excavated ground line, the lagging and backfill shall be placed concurrently. The backfill layers shall be placed in accordance with Section 2-03.3(14) except that all layers shall be compacted to 90-percent of maximum density.

6-16.3(7) Prefabricated Drainage Mat

For walls with concrete fascia panels, prefabricated drainage mat shall be installed full height of the concrete fascia panel and full width between soldier pile flanges, unless otherwise shown in the Plans.

The prefabricated drainage mat shall be attached to the lagging in accordance with the manufacturer's recommendations. The fabric side shall face the lagging. Splicing of the prefabricated drainage mat shall be in accordance with the manufacturer's recommendations.

The Contractor shall ensure the hydraulic connection of the prefabricated drainage mat to the previously installed material so that the vertical flow of water is not impeded.

The Contractor shall tape all joints in the prefabricated drainage mat to prevent concrete intrusion during concrete fascia panel construction.

6-16.3(8) Concrete Fascia Panel

The Contractor shall construct the concrete fascia panels as shown in the Plans, and in accordance with the forming plan as approved by the Engineer. The concrete fascia panels shall be cured in accordance with the Section 6-02.3(11) requirements specified for retaining walls.

The Contractor shall provide the specified surface finish as noted, and to the limits shown, in the Plans to the exterior concrete surface. When noted in the Plans, the Contractor shall apply pigmented sealer to the limits shown in the Plans.

Asphalt or cement concrete gutter shall be constructed as shown in the Plans.

6-16.4 Measurement

Soldier pile shaft construction will be measured by the linear foot of shaft excavated below the top of ground line for the shaft, defined as the highest existing ground point within the shaft diameter.

Furnishing soldier pile will be measured by the linear foot of pile assembly specified in the Proposal, including adjustments to the Plan quantity made in accordance with Section 1-04.4.

Timber lagging will be measured by the thousand board feet measure (MBM) installed. The quantity will be computed using the nominal thickness and width dimensions of the timber lagging members, and the center-to-center spacing of the soldier piles as the length dimension.

Prefabricated drainage mat will be measured by the square yard of material furnished and installed.

Concrete fascia panel will be measured by the square foot surface area of the completed fascia panel, measured to the neat lines of the panel as shown in the Plans.

6-16.5 Payment

Payment will be made in accordance with Section 1-04.1 for each of the following Bid items when they are included in the Proposal:

“Shaft - ____ Diameter”, per linear foot.

All costs in connection with constructing soldier pile shafts shall be included in the unit Contract price per linear foot for “Shaft - ____ Diameter”, including shaft excavation, temporary casing if used, CDF, lean concrete, concrete Class 4000P, and installing the soldier pile assembly.

“Furnishing Soldier Pile - ____”, per linear foot.

All costs in connection with furnishing soldier pile assemblies shall be included in the unit Contract price per linear foot for “Furnishing Soldier Pile - ____”, including fabricating and painting the pile assemblies. Payment will be made based on the quantity specified in the Proposal unless changes are made to this quantity in accordance with Section 1-04.4, in which case the quantity specified in the Proposal will be adjusted by the amount of the change and will be paid for in accordance with Section 1-04.4.

“Timber Lagging”, per MBM.

All costs in connection with furnishing and installing timber lagging shall be included in the unit Contract price per MBM for “Timber Lagging”, including preservative treatment when specified, and filling voids behind the lagging with gravel backfill for wall.

“Prefabricated Drainage Mat”, per square yard.

“Concrete Fascia Panel”, per square foot.

All costs in connection with constructing the concrete fascia panels as specified shall be included in the unit Contract price per square foot for “Concrete Fascia Panel”, including all steel reinforcing bars, premolded joint filler, polyethylene bond breaker strip, joint sealant, PVC pipe for weep holes, exterior surface finish, and pigmented sealer (when specified).

Unless otherwise specified, all costs in connection with non-shaft excavation, including all excavation required for placement of timber lagging, shall be included in the unit Contract price per cubic yard for “Roadway Excavation” or “Roadway Excavation Incl. Haul” as specified in Section 2-03.5.